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The Theory of Planned Behavior and E-cig Use: Impulsive Personality, E-cig Attitudes, and E-cig Use

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Abstract

The current paper applied the Theory of Planned Behavior (TPB; Ajzen & Fishbein, 1988) to understand how impulsive personality traits and attitudes concerning e-cig use relate to the likelihood of electronic cigarette (e-cig) use. Seven hundred and fourteen participants (Mean age = 34.04, SD = 10.89, 48.6% female) completed cross-sectional measures of e-cig use attitudes (CEAC) and the Short UPPS-P Impulsive Behavior Scale. A structural path analysis suggested that urgency and deficits in conscientiousness were significantly related to e-cig attitudes (CFI = 0.99, TLI = 0.99, RMSEA = 0.02; urgency: $\beta = 0.32$, $p = .001$; deficits in conscientiousness: $\beta = -0.48$, $p < .001$). E-cig attitude scores were significantly higher for e-cig users than non-users, $\beta = 0.85$, $p < .001$. There was no significant direct path from impulsive personality traits to e-cig use. Findings provide initial support for a model in which impulsive traits are related to e-cig use through positive e-cig attitudes.

Keywords

impulsivity; personality; attitudes; e-cig

Introduction

Electronic cigarettes (e-cigs) are a form of nicotine delivery that approximates a cigarette in experience, nicotine absorption, and serum cotinine levels (American Cancer Society, 2014; Dawkins et al., 2012; Flouris et al., 2013; Grana et al., 2014). Although the global prevalence of e-cig use is not well documented, according to the World Health Organization (2016) the global market for the e-cig industry is approximately 10 billion dollars, with 56% accounted for by the United States, 12% by the United Kingdom, and 21% divided between China, France, Germany, Italy and Poland (WHO, 2016), thus e-cig consumption is wide-spread globally. This is potentially problematic, as there are mixed findings regarding the potential health benefits and risks for e-cigs (FDA, 2014). For example, recent research using animal models has demonstrated that e-cig liquid, independent of the effects of nicotine, resulted in decline in lung endothelial barrier function and inflammation

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(Schweitzer et al., 2015), which can lead to hypertension, high blood pressure, and cardiovascular disease (Siasos et al., 2012). Given increased rates of e-cig use and the potential negative health risks of e-cig use, there is a great need to better understand individual risk factors for e-cig use in order to better tailor potential interventions. However, underlying risk factors for e-cig use are not yet well understood.

The goal of the current paper is to apply the Theory of Planned Behavior (TPB; Ajzen & Fishbein, 1988) to e-cig use. The TPB proposes that a person's attitudes, subjective norms, and perceived behavioral control towards a behavior are related to their intention to carry out, and ultimately, to carrying out the behavior. In the present study, we examined how impulsive personality traits, one global process likely involved in e-cig use behaviors (Cohn et al., 2015) and attitudes concerning e-cig use relate to the likelihood of e-cig use, in order to begin to establish a framework for examining and intervening upon risk for e-cig use.

First, one potential risk factor for e-cig use is impulsivity (Cohn et al., 2015). Impulsivity is a multi-dimensional construct, likely composed of five separate, although related, impulsive traits (Whiteside & Lynam, 2001), which map onto three latent factors (Cyders & Smith, 2007; Cyders et al., 2014): 1) *urgency*, which is comprised of *negative urgency*, or a disposition to act rashly in response to negative affect, and *positive urgency*, or a disposition to act rashly in response to positive affect, 2) *deficits in conscientiousness*, which is comprised of *lack of perseverance*, or difficulties seeing tasks through completion, and *lack of premeditation*, or acting before thinking, and 3) *sensation seeking*, or seeking out novel and/or exciting experiences. These traits have shown differential relationships with smoking behaviors (Lee et al., 2015), with urgency being the strongest predictor of cigarette use, above and beyond other impulsive personality traits (Lee et al., 2015; Pang et al., 2014). Although no work has examined how e-cig use is related to the above-described factors, some recent work suggests that sensation seeking is related to e-cig use (Cohn et al., 2015). Therefore, we view impulsive personality traits as a viable, promising global risk factor for e-cig use. Importantly, the TPB further suggests that global processes (e.g. personality) influence in-the-moment processes (situational factors), such as attitudes towards e-cigs (Ajzen & Fishbein, 1988); however, this has yet to be examined with e-cig use. We propose that impulsive personality is one global process that will be related to e-cig use through, in part, their relationship with positive e-cig use attitudes. Thus, we aim to extend the TPB to include the influence of impulsive personality traits on attitudes, specifically towards e-cigs.

Second, research on e-cig users has strongly supported the role of relevant attitudes in the e-cig use risk process. E-cig users endorse a number of positive attitudes towards e-cig use, such as that e-cigs are healthier, more socially enhancing, and more satisfying than cigarettes (Harrell et al., 2014; Hendricks et al., 2015; Pepper et al., 2014; Peters et al., 2015; Pokhrel et al., 2014; Hershberger et al., 2017) and such attitudes are associated with not only current e-cig use, but also with future intent to use e-cigs and actual future use of e-cigs (Andrews, et al., 2016). Thus, attitudes towards e-cig use are a potential risk factor for e-cig use.

Therefore, the goal of the current study was to examine the viability of applying the TPB to e-cig use and extending this model to include impulsive personality. First, we hypothesized that 1) e-cig users would report higher trait levels of impulsivity than non-users (Cohn et al.,

2015), and 2) e-cig users would report higher levels of positive e-cig attitudes (e.g., Harrell et al., 2014; Hendricks et al., 2015; Pepper et al., 2014; Peters et al., 2015; Pokhrel et al., 2014; Hershberger et al., 2017). Next, we hypothesized that impulsive personality traits would be related to e-cig use, in part, because the relationship would be mediated by positive attitudes towards e-cigs. This is a novel and important endeavor. Although the current study utilizes cross-sectional data, our choice of causal direction is supported by the following: 1) impulsive personality traits, which are present quite early in life (Zapolski et al., 2010), predate the development of e-cig attitudes rather than these attitudes predating personality development; 2) the TPB suggests that personality is a global process that influences attitude development (Ajzen & Fishbein, 1988); and 3) both impulsivity and attitudes are present prior to the onset of e-cig use (e.g., Andrews et al., 2016). Examining the causal model first in this cross-sectional data would provide initial support for viability of the model and suggests further examination in a prospective sample. Prior work has suggested a strong role of attitudes in e-cig use; however, what contributes to the development of such attitudes is not yet documented. Although some work has suggested a relationship between sensation seeking and e-cig use, no work has examined a multi-dimensional model of impulsive personality traits for e-cig use and e-cig attitude endorsement. Knowledge of how global impulsive personality trait risk factors are related to both positive e-cig use attitudes and e-cig use risk would 1) catalyze future prospective work in this area, 2) contribute to a more thorough, theory-grounded approach to e-cig research, and 3) potentially suggest novel strategies for intervening upon e-cig use when appropriate.

Methods

Participants

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000. The study received Institutional Review Board Approval from Indiana University. Informed consent was obtained from all participants for being included in the study. The initial sample included 743 participants recruited from Amazon's Mechanical Turk (MTurk), which is an online web service that connects researchers with individuals willing to complete tasks for a wage (www.mturk.com). Inclusion criteria were: 21 years or older, able to read and understand questions in English, live in the United States, and drink alcohol (alcohol use assessed for unrelated aim; see Hershberger, et al., 2016) A total of 29 participants were removed for failing two or more careless responding checks.

Materials

Demographics and Product Use Status—Participants reported: 1) age, gender, and ethnicity and 2) e-cig use ("Do you use electronic-cigarettes currently", Yes/No response).

Careless responding—Careless responding was assessed by the use of four "bogus items" placed throughout the test ("I have never brushed my teeth," "I do not understand a word of English," "I sleep less than one hour per night," and "I have been to every country in the world"). Participants responded to items on a 1 (agree strongly) to 7 (disagree

strongly) scale. Participants (n = 29) responding with a 1 or 2 on two or more careless responding items had their data removed from analysis (Meade & Craig, 2012).

Impulse related personality traits—The Short UPPS-P Impulsive Behavior Scale-Revised (SUPPS-P; Lynam, 2013) was used to measure negative urgency, positive urgency, sensation seeking, lack of perseverance, and lack of premeditation. It consists of twenty items with responses ranging from 1 (agree strongly) to 4 (disagree strongly), with four items used to assess each trait. Responses were coded so that higher scores indicate higher levels of trait impulsivity. Reported scores represent the total score for each scale. The SUPPS-P was adapted from the 59-item UPPS-P (Lynam et al., 2007). The SUPPS-P subscales have similar reliability and validity as the original scale (Cyders et al., 2014). All five SUPPS-P subscale scores had adequate internal consistency in the present sample (α = 0.58 to 0.79).

Comparing E-cigarettes and Cigarettes questionnaire (CEAC)—The CEAC (Hershberger, et al., 2017; Table I) was used to assess attitudes towards e-cigs, compared to cigarettes. The CEAC is a seventeen-item self-report measure with three factors: 1) *General Benefits* (7 items; α = 0.85), 2) *Addiction/Cessation Benefits* (5 items; α = 0.89), and 3) *Improve Health* (5 items; α = 0.92). The CEAC has been shown to be positively related to e-cig use (*b's* 0.41–1.24, *p's* < .01; Hershberger et al., 2017) and has demonstrated good psychometric properties (α's 0.83–0.93)

Procedure

The present study was entitled "E-cigarette, cigarette, and alcohol use survey" and posted onto the MTurk website. Those individuals who signed up to participate were given a URL to complete the study questionnaires via Survey Monkey. Participants were first asked if they drink alcohol and if they were over the age of 21; responding no to either item resulted in disqualification. Participants that met study requirements responded to the above-described questionnaires and then entered a survey code to receive their compensation ($0.75 for approximately 15 minutes which is consistent with previous MTurk compensation rates; Horton et al., 2010).

Results

Preliminary Analyses and Participant Characteristics

Twenty-nine participants were excluded from data analysis for failing two or more careless responding items. Those excluded did not differ from the remaining sample in gender or ethnicity (*p's* .31 to .73). The final sample was N = 714 (Mean age = 34.04, SD = 10.89, 48.6% female, 85.1% Caucasian, 4.7% Black, 4.1% Hispanic). Participants were comprised of 69.7% non-users and 30.3% e-cig users. Table II provides descriptive statistics by e-cig use status. Less than .01% of CEAC and SUPPS-P data appeared to be missing at random and was imputed using multiple imputation. Average scores on the SUPPS-P scales ranged from 1–4 and CEAC subscale scores ranged from 1–5 (General Benefits), 1–5 (Addiction/Cessation Benefits), and 0–4 (Improve Health). Table III provides mean scale scores by e-cig user status. SUPPS-P scales were intercorrelated (r's −.07 to 0.66, p's .04 to < .001), and

CEAC scales were intercorrelated (*r*'s 0.61 to 0.71, *p*'s<.001; see Table III). E-cig use was significantly associated with all CEAC subscales (*r's* 0.62 to 0.70, *p*'s < .001). Table III presents correlations between SUPPS-P and CEAC average scale scores.

Test of the TPB for E-cig Use

First, we conducted a confirmatory factor analysis using the lavaan package in R3.0.1 (Beaujean, 2014), in which we examined the viability of our latent model: We defined three impulsive personality latent variables (*urgency, deficits in conscientiousness,* and *sensation seeking*) using the five-facets of the SUPPS-P as indicators by fixing the loading of the first sub-facet on each factor to 1 (Cyders & Smith, 2007; Cyders, et al., 2014): A latent variable of e-cig attitudes was defined by three measured variables from the CEAC: *General Benefits, Addiction/Cessation Benefits*, and *Improve Health*. Each CEAC measured variable was created as the average of items loading on that scale. To assess the degree of fit, we used the following indices with fit recommendations in parentheses as suggested by Hu & Bentler (1998): Root Mean Square Error of Approximation (RMSEA < 0.10); Tucker Lewis Index (TLI > 0.95); and Comparative Fit Index (CFI > 0.95). Overall, this confirmatory model showed good fit (CFI = 0.98, TLI – 0.97, RMSEA = .05 (0.03 – 0.07).

We then conducted a structural path analysis (Figure 1) using the above-identified latent variables. E-cig use was identified as a measured dichotomous variable (e-cig use or no e-cig use). We included pathways from 1) each of the three SUPPS-P latent variables to 2) the latent variable of e-cig attitudes to 3) the latent variable of e-cig use and allowed the SUPPS-P variables to intercorrelate. Overall, this model demonstrated good fit (Figure 1): CFI = 0.99, TLI = 0.99, RMSEA = 0.02 (0.00– 0.04, 90% confidence interval). Urgency, $\beta = 0.32$, $p = .001$, and deficits in conscientiousness, $\beta = -0.48$, $p < .001$, were significantly related to e-cig attitudes, but not sensation seeking, $\beta = 0.02$, $p = .70$. E-cig attitude scores were significantly higher for e-cig users than non-users, $\beta = 0.85$, $p < .001$. There were no significant direct paths from impulsivity traits to e-cig use (*urgency*: $\beta = .06$, $p = .63$; *deficits in conscientiousness*: $\beta = 0.13$, $p = .57$; *sensation seeking*: $\beta = 0.03$, $p = .63$).

Discussion

Findings suggest that urgency is uniquely related to e-cig use attitudes and the endorsement of these attitudes is related to likelihood of e-cig use. Additionally, individuals reporting larger deficits in conscientiousness reported less positive attitudes towards e-cig use. Although in cross-sectional data, this is the first step in a trajectory of research in examining global and specific processes that relate to e-cig use. This study suggests viability of applying the TPB to e-cig use and examining this effect in future prospective data to increase certainty in the validity of this causal model.

The current study supports and extends previous work that reported a relationship between impulsive personality traits and e-cig use; however, unlike previous data, no significant relationship was found between sensation seeking and e-cig use (Cohn et al., 2015). Such findings could be the result of differences in samples (e.g. data from Cohn et al., 2015 drawn from 18–24 year olds). Current findings do provide initial support for the viability of a causal model by which urgency might be risk factors for e-cig attitude endorsement and

subsequent e-cig use. Urgency has previously been shown to be related to the development of positive substance use expectancies (e.g. Settles et al., 2010), which then further exacerbates and places one at risk for substance use and related problems. Impulsive personality traits likely impart this risk through several mechanisms. First, impulsive personality predisposes one to attend to and remember positive aspects of the substance (e.g. Settles et al., 2010). Therefore, it would make it likely for individuals to pay attention to and remember positive attributes of e-cigs, even when the person is naïve to e-cigs, through observations of others (e.g., friends using e-cigs, observations of individuals in TV/movies, from e-cig advertising campaigns, etc.).

Additionally, importance is that individuals reporting higher conscientiousness endorsed more positive attitudes towards e-cigs, compared to cigarettes. Recent data indicate that individuals exposed to e-cig advertisements tend to have more positive attitudes towards e-cigs (Pokhrel et al., 2016). As individuals high in conscientiousness may be more likely to examine these e-cig advertisements, it is not surprising that these same individuals may be more likely to have positive attitudes towards e-cigs, compared to cigarettes. Additionally, although e-cigs do pose some health risks, it is likely that e-cigs are less harmful than cigarettes (e.g. Cervellati et al., 2014), so individuals that are more conscientious may endorse more positive attitudes towards e-cigs, compared to cigarettes, based on such findings.

If replicated by future studies, the current line of research could suggest prime, novel strategies to mitigate or reduce e-cig use, particularly among youth and others who are high in urgency. Intervening on attitudes or expectancies related to substance use has shown to be efficacious in reducing substance use (Lau-Barraco & Dunn, 2008) and could be effective for reducing e-cig use as well. Additionally, impulsive personality traits can be capitalized upon in interventions. There is evidence to indicate that public service announcements that appeal to individuals high in impulsive personality are effective at reducing risk-taking behaviors (e.g., Zimmerman et al., 2007) and this effect could generalize to e-cig use. For example, public campaigns to increase awareness about the negative effects of e-cigs could use exciting and stimulating materials to capture the attention of individuals high in impulsive personality. Also, it may be possible to capitalize on individuals high in conscientiousness by presenting advertisements or designing interventions that also highlight the potential health risks of e-cigs. For example, data indicates that e-cig vapor is less cytotoxic than cigarette smoke, particularly when examining effects of e-cig flavorings and nicotine; however, e-cigs are still cytotoxic, to a lesser degree (Cervellati et al., 2014). Presenting such findings publicly or through interventions could aid in creating a more balanced view of e-cigs, particularly for individuals high in conscientiousness, which may be most likely to pay attention to such information. Overall, if findings are replicated, it could be beneficial for researchers to examine the efficacy of clinical assessment of impulsive personality and e-cig attitudes in e-cig users and to determine the risk of e-cig use, given that e-cigs are potentially harmful. Although significant clinical research is needed, such traits and attitudes may be specifically targeted to mitigate risks, and future research should examine the viability of targeting impulsive personality and attitudes. Attitudes could be challenged in the context of CBT treatment, similar to current strategies used in other substance abuse treatments, and although there is limited research examining intervening

upon impulsive personality traits, research suggests targeting these traits may also mitigate risk for substance use (e.g. Loree et al., 2015), and may generalize to e-cig use. Future clinical research should examine means to target attitudes towards e-cigs and impulsive personality and examine if changes in attitudes and impulsive personality correspond to reduced intent to use e-cig and overall e-cig use.

Though the present study calls important attention to the significance of personality and attitudes in examining e-cig use; there are some limitations to discuss. First, participants self-reported their data online, which could be affected by self-report biases. However, laboratory and in-person survey measures face similar challenges that rely on the openness of the participants (Kraut et al., 2004). Second, the present study is cross-sectional in nature, and therefore no causal inferences can be drawn; however, the causal direction chosen is supported by strong previous empirical work and theory. Third, participants self-selected to take part in the study; thus, those who used e-cigs could have been more likely to participate, which could limit generalizability. Fourth, the theory of planned behavior posits that attitudes lead to behavioral intent, and ultimately, the behavior. The present study did not assess behavior intent, but rather the direct path from attitudes to current e-cig use. Future studies should examine the mechanistic role of e-cig use intent between attitudes and e-cig use in order to strengthen the TPB model of e-cig use.

Despite such limitations, this is the first study to examine how impulsive personality traits might relate to e-cig use through influencing e-cig use attitudes, as grounded in the TPB. The current study is the first step in examining a causal model in which impulsive personality contributes to e-cig attitude endorsement and use. These initial findings indicate that urgency, deficits in conscientiousness, and attitudes are likely important risk factors for e-cig use and suggest viability of testing this causal model in future prospective and experimental designs, as both predicting risk for e-cig use and as a potential strategies to reduce risk for e-cig use. In the pursuit of developing a well-grounded model of e-cig use, research should move towards a comprehensive understanding of e-cig use, including but not limited to, norms, intent, behavioral control, personality, e-cig user prototypes, and substance use history. It is likely that these factors interact and produce varying behavioral outcomes, and as such, this information can aid research in developing targeted and more effective prevention and intervention strategies for e-cig use.

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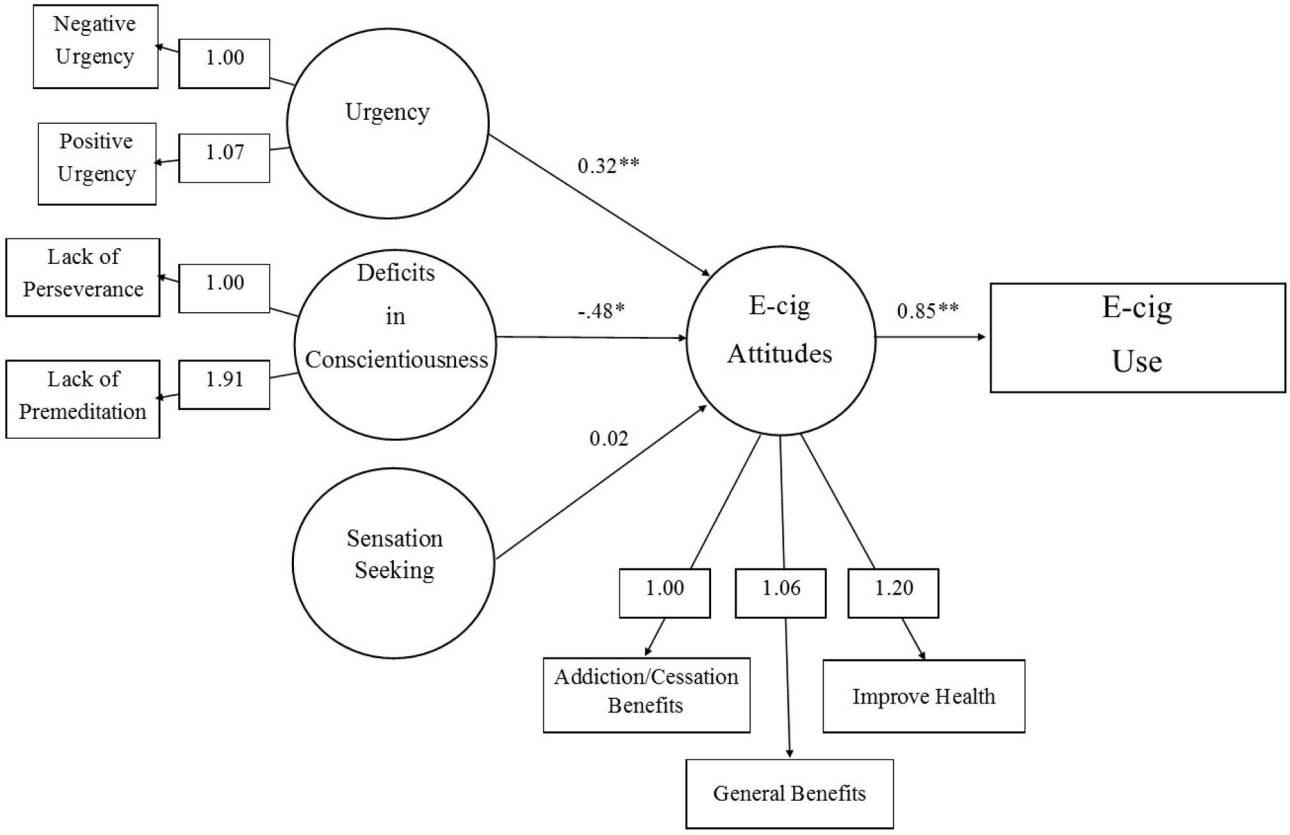

Figure 1.

Structural path analysis examining the relationship between impulsive personality traits (Urgency, Deficits in Conscientiousness and Sensation Seeking), E-cig attitudes, and E-cig Use. CFI = 0.99, TLI = 0.99, RMSEA = 0.02 (0.00 – 0.04, 90% confidence interval). *$p < .01$; $p < .001$

Table I

Comparing E-cigarettes and Cigarettes Questionnaire (CEAC)

General Benefits
1. Electronic cigarettes can be used to quit or cut down on smoking traditional cigarettes
2. Electronic cigarettes are less expensive than traditional cigarettes
3. Electronic cigarettes are more convenient or easier to use than traditional cigarettes
4. Electronic cigarettes are more enjoyable to use than traditional cigarettes
5. Electronic cigarettes are more socially acceptable to use than smoking traditional cigarettes
6. Electronic cigarettes are less harmful to the users' health than traditional cigarettes
7. Electronic cigarettes are less harmful to the health of those in close proximity to the user than traditional cigarettes
Addiction/Cessation Benefits
8. Electronic cigarettes are less addictive than traditional cigarettes
9. Electronic cigarettes will not produce as much cravings as traditional cigarettes
10. Electronic cigarettes will produce fewer withdrawal symptoms compared to traditional cigarettes
11. Electronic cigarettes can reduce cravings for traditional cigarettes
12. Electronic cigarettes can reduce withdrawal symptoms from traditional cigarettes, such as anger, anxiety, depression, sleep disturbance and increased appetite
Improve Health
13. Compared to traditional cigarettes, electronic cigarettes can improve health
14. Using electronic cigarettes, compared to traditional cigarettes, can improve smoker's cough and ability to breathe
15. Using electronic cigarettes, compared to traditional cigarettes, can improve ability to engage in physical activities and exercise
16. Using electronic cigarettes, compared to traditional cigarettes, can improve my general sense of smell
17. Using electronic cigarettes, compared to traditional cigarettes, can improve my sense of taste

Table II

Sample characteristics by E-cig and Non E-cig Users

	E-cig Users (N = 212)	Non E-cig Users (N = 485)
Age Mean (SD)	33.79 (10.40)	34.15 (11.12)
Male N (%)	113 (53.3%)	251 (51.7%)
Female	99 (46.7%)	234 (48.6%)
White	187 (88.2%)	415 (85.7%)
Black	8 (3.8%)	25 (5.2%)
Asian	7 (3.30%)	21 (4.3%)
American Indian/Alaskan Native	0	2 (0.4%)
Hispanic or Latino Origin	9 (4.3%)	20 (4.1%)

Note. Descriptive statistics for present sample by e-cig use status. Comparisons run by e-cig use status for age (independent samples t-test), gender, and race/ethnicity (chi-square), with no significant differences between groups. Total reporting gender = 697; Total reporting race/ethnicity = 694.

Table III

Study variable descriptive statistics.

Measure	Subscale	Mean (SD) Non-Users	Mean (SD) E-cig Users	SUPPS-P *Pearson's* r				CEAC *Pearson's* r		
				2.	3.	4.	5.	6.	7.	8.
SUPPS-P	**1. Negative Urgency**	2.04 (0.69)[a]	2.19 (0.78)[a]	0.65***	0.35***	0.20***	0.17***	0.09*	0.11**	0.09**
	2. Positive Urgency	1.67 (0.59)[b]	1.80 (0.63)[b]	-	0.42***	0.23***	0.32***	0.10**	0.12**	0.10**
	3. Lack of Premeditation	1.64 (0.50)	1.67 (0.53)	-	-	0.53***	0.09*	.09*	0.03	.09*
	4. Lack of Perseverance Average	1.69 (0.49)	1.66 (0.50)	-	-	-	−.08*	−0.06	−0.07	−0.06
	5. Sensation Seeking	2.36 (0.73)	2.46 (0.72)	-	-	-	-	0.01	−0.02	−.08*
CEAC	**6. General Benefits**	3.31 (0.79)[c]	4.02 (0.72)[c]					-	0.68***	0.70***
	7. Addiction/ Cessation	2.98 (0.90)[d]	3.61 (0.87)[d]							0.61***
	8. Improve Health	2.05 (0.97)[e]	2.90 (0.92)[e]							

Note. Mean and standard deviations for the Short UPPS-P Impulsive Behavior Scale (SUPPS-P) and Comparing E-cigarettes And Cigarettes questionnaire (CEAC). Means reflect mean item scores for each subscale. Pearson's *r* correlations are presented between mean subscale scores of the SUPPS-P and CEAC.

* $p < .05$

** $p < .01$

*** $p < .001$;

[a] $t(696) = -2.56$, $p = .01$, $d = 0.21$

[b] $t(696) = -2.43$, $p = .01$, $d = 0.22$

[c] $t(696) = -11.35$, $p < .001$, $d = 0.93$

[d] $t(696) = -8.56$, $p < .001$, $d = .71$

[e] $t(696) = -10.80$, $p < .001$, $d = 0.89$